REMARKS

Please reconsider the application in view of the above amendments and the following remarks. Applicant thanks the Examiner for carefully considering this application

Disposition of Claims

Claims 2-9, 11-23, 25-38, 40, 45, and 46 are pending in this application. Claims 45 and 46 are independent. The remaining claims depend, directly or indirectly, from claims 45 and 46.

Claim Amendments

Independent claims 45 and 46 have been amended to clarify the invention. Support for these amendments may be found, for example, in the present Application at paragraph [0041]. No new matter has been added by these amendments.

Rejections under 35 U.S.C. § 103

In the Office Action, the Examiner rejected claims 2-9, 11-23, 25-38, 40, 45, and 46 under 35 U.S.C. § 103(a) as being unpatentable over "The Operational Mechanics of The Rock Bit," by Ma, *et al.* (hereinafter "Ma"), in view of U.S. Patent No. 6,695,073, issued to Glass, *et al.* (hereinafter "Glass"), in view of U.S. Patent Publication No. 2001/0020552 ("Beaton") and further in view of U.S. Patent No. 6,039,131 ("Beaton2"). Claims 2-9 and 11-23 depend, directly or indirectly, from independent claim 45. Claims 25-38 and 40 depend, directly or indirectly, from independent claim 46. Claims 45 and 46 have been amended in this reply.

To the extent this rejection applies to the claims as amended, this rejection is respectfully traversed.

Improper Combination of References

Initially, Applicant notes that the combination of references (*i.e.*, Beaton, Beaton2, Ma, and Glass) is improper. Beaton and Beaton2 are not applicable to the methods required by the presently amended claims because Beaton and Beaton2 relate only to bi-center drill bits. (Beaton, Abstract and Beaton2, col. 1, lines 16-20). Also, Ma is not applicable because it relates to roller cone bits and Glass is not applicable because it enables only PDC bits. (*See generally*, Ma); (Glass, Background).

Bi-center bits are known in the art to drill a wellbore having a pass-through diameter that is greater than a diameter of the bit. Such bits are used to provide a wider borehole by including a side of the bit with a longer radius than an opposite side of the bit. (Beaton Fig. 2; and Beaton2, Fig. 2). Because bi-center bits have imbalanced forces due to the differences in radius on opposing sides, they will typically exhibit a degree of directional instability that is tolerated because of the advantages of having a wider borehole. However, the inherent directional instability present in bi-center bits means that methods of force balancing, such as those disclosed in Beaton and Beaton2, is performed in a different manner and for a different purpose than the calculations required by claims 45 and 46.

For example, Beaton2 discloses that "the drilling center of conventional bi-center bits tends to fluctuate," and further states that "it is desir[able] to provide a bi-center PDC bit that is capable of drilling a hole larger than its pass-through diameter and that provides superior directional control and steerability." (Beaton2, col. 3, lines 19-21 and lines 26-29). As such,

force balancing for bi-center bits focus on achieving directional control and steerability, whereas the methods required by claims 45 and 46 are implemented to reduce bit whirl. Claims 45 and 46 thus require methods of designing drill bits and bottomhole assemblies using radial force measurements. (Present Application, paragraphs [0032]-[0050]). Therefore, methods of force balancing disclo1sed by Beaton and Beaton2 are not applicable to methods required by the present claims.

Beaton and Beaton2 are not properly combinable with Glass. Glass is directed to bits having a single cutting structure. (Glass, Background and Figures 2-3B). As discussed above, bi-center bits have a side of the bit with a longer radius than an opposite side of the bit, thus they have at least two cutting structures. In designing a bit having multiple cutting structures, adjustments for each cutting structure are made in relation to the other cutting structures on the bit. Thus, the design methodology for a bit having a single cutting structure is fundamentally different than that for a bit having multiple cutting structures. A person of ordinary skill in the art would have no reason to look to modeling methods for a bit with multiple cutting structures when designing modeling methods for a bit with a single cutting structure. Further, none of Beaton, Beaton2, and Glass teach or suggest looking to modeling methods for bits with multiple cutting structures when designing modeling methods for a bit with only a single cutting structure. Even if Beaton and Beaton2 could be combined with Glass, these references are not properly combinable with Ma, which is applicable only to roller cone bits, as explained in detail below.

Beaton and Beaton2 are not properly combinable with Ma because Ma relates to roller cone bits. Roller cone bits use a crushing action to remove rock, cutting the formation by cones rolling around the borehole bottom (rotating about spindles) due to the rotation of the drill

bit/drill string. The rolling action of roller cone bits is fundamentally different than the shearing action of the PDL bits of Beaton, Beaton2, and Glass. In other words, roller cone bits have a different cutting action than bi-center bits or PDC bits. The difference in cutting action requires different methods of modeling, and modeling programs for bits having a crushing action are not interchangeable with modeling programs for bits having a shearing action. It is not possible to interchange one type of bit modeling for use on another type of bit; this would result in the modeling being unusable for its intended purpose. Therefore, the combination of Beaton, Beaton2, Ma, and Glass is improper because their respective methods of design may not be incorporated together.

Further, while the Examiner mentions in passing that Beaton, Beaton2, Ma, and Glass are all directed to drill bit design, the Examiner never identifies why one of ordinary skill in the art would be motivated to combine methods of designing roller cone drill bits with methods of designing bi-center drill bits and methods of designing PDC bits. As indicated above, roller cone drill bits rely on crushing to break formation. Thus, the craters generated by the modeling methods of Ma would be created using a fundamentally different cutting action than the craters generated by Beaton, Beaton2, and Glass. The differences in the cutting action on the formation fundamentally prevent PDC and roller cone bit simulation programs from being interchangeable.

In view of the above, there is no suggestion or motivation in any of the cited references that would enable one skilled in the art to use to this combination of references to achieve the claimed invention. Prior to the present disclosure, methods for designing a drill bit or a bottomhole assembly using radial forces and weight on bit, such as that required in part by the presently claimed invention, was not considered. Recently, the Supreme Court issued its

opinion in *KSR v. Teleflex*. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007). Although finding the teaching-suggestion-motivation test too narrow to be applied in a determination test for obviousness, the court underscored the importance of viewing the obviousness through the eyes of one skilled in the art. Thus, even in view of *KSR Int'l Co. v. Teleflex, Inc.*, "[a]n obviousness determination is not the result of a rigid formula disassociated from the consideration of the facts of a case. Indeed, the common sense of those skilled in the art demonstrates why some combinations would have been obvious where others would not." *Id.* Clearly, the combination of references used by the Examiner to reject the claims of the present application is not a combination that one skilled in the art would turn to in arriving at the present invention.

The Appellant also respectfully notes that an obviousness determination requires not only the existence of a motivation to combine elements from different prior art references, but also that a skilled artisan would have perceived a reasonable expectation of success in making the invention via that combination. However, to have a reasonable expectation of success, one must be motivated to do more than merely "vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful." *In re O'Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988).

In the present case, one of ordinary skill in the art would not combine methods of modeling roller cone bits with methods of modeling bi-center drill bits and methods of modeling PDC bits. Ma does not provide an explanation as to how roller cone modeling may be used in PDC or bi-center modeling. Likewise, Glass does not teach or suggest the use of bi-center or roller cone analysis with PDC drill bits and Beaton and Beaton2 do not provide any suggestion

to use bi-center modeling with roller cone or PDC modeling. Accordingly, one of ordinary skill in the art would not have had an expectation of success from combining Beaton, Beaton2, Ma and Glass, prior to the present disclosure.

When a combination of references suggests different purposes, the combination of references does not result in a finding of obviousness. *In re Wright*, 848 F.2d 1216 (Fed. Cir. 1988) (finding the PTO erred in arguing that "if it is obvious to combine the teachings of prior art references for any purpose, they may be combined in order to defeat patentability of the applicant's admittedly new structure" and that "it is irrelevant that [the claimed] structure was for a purpose, and has properties, that are neither obtainable from the prior art structures, nor suggested in the prior art."). The present application defines new methods for designing a drill bit or a bottomhole assembly using radial forces and weight on bit. Drill bit design or bottomhole assemblies using radial forces and weight on bit, according to the methods of the present Application, are not taught by the combination of Beaton, Beaton2, Ma or Glass, whether taken independently or in combination. Thus, the claimed methods are for a different purpose and include aspects that are not obtainable from any combination of Beaton with Beaton2, Ma, and Glass.

The only support that the Examiner proffers that Beaton, Ma and Glass are properly combinable is that they are each directed to modeling a drill bit. (Office Action, pages 7, 8, 10 and 11). However, there is no reference to applying the modeling methods of their respective bit types to other bit types in any of the references. Ma is directed to roller cone bits, and one of ordinary skill in the art, upon reading Ma, would not combine Ma with Beaton, Beaton2, or Glass. Likewise, Glass is directed to PDC bits, and one of ordinary skill in the art, upon reading Glass, would not combine Glass with Beaton, Beaton2, or Ma. Further, Beaton

and Beaton2 are directed to bi-center bits, and one of ordinary skill in the art, upon reading either Beaton or Beaton2, would not combine either Beaton or Beaton2 with Glass or Ma, as discussed above.

Because none of Beaton, Beaton2, Glass, or Ma suggest that the elements described therein are interchangeable in bi-center bit modeling and roller cone bit modeling as well as PDC bit modeling, the combination of these references could not be used to produce the present invention. *See Carella v. Starlight Archery*, 804 F.2d 135 (Fed. Cir. 1986). As such, one of ordinary skill in the art would have no motivation to combine Beaton and Beaton2 with Glass or Ma, and the present obviousness rejection is improper.

Combination of References Does Not Result in Presently Claimed Invention

Even assuming *arguendo* that Beaton and Beaton 2 could be properly combined with Glass and Ma, the combination of these references does not result in the presently claimed invention because these references do not disclose each and every element of the presently claimed invention. A *prima facie* case of obviousness requires that all claim limitations be taught or suggested by the prior art. *See In re Royka*, 490 F.2d 981 (CCPA 1974). If even a single claim limitation is not taught or suggested by the prior art, then that claim cannot be obvious over the prior art. *Id.* Because Beaton, Beaton 2, Glass, and Ma do not disclose the methods for designing a drill bit or a bottomhole assembly using radial forces and weight on bit required in part by the present claims, the combination of Beaton and Beaton 2 in view of Glass and Ma does not constitute a proper obviousness rejection.

Conventionally, forces exceeding a specific amount must be reduced to bring them closer to the magnitude of other similar forces on the bit. (Glass, col. 5, lines 61-63

(stating, "the present application does teach that reducing peak cutter loadings in the transition zone, by balancing cutter loads, is advantageous")); (Beaton, paragraph [0034] (stating, "it has been determined that the drilling stability of a bi-center bit can be further improved by force balancing the entire bit as a single structure")); and (Beaton2, col. 5, lines 5-8 (stating that "the total imbalance force will be the vector sum of the two forces, [either an imbalance force and opposing imbalance force or a circumferential imbalance force and a radial imbalance force]" and to "minimize" this vector sum)). The methods required by the present claims require temporal limitations, for example having a specified amount of time during which a criterion must be met.

Claims 45 and 46 have been amended to clarify, in part, the element of time used in an adjusting step. Specifically, claim 45 has been amended to require, in part, a method for designing a drill bit, including: determining radial forces acting on a selected drill bit during simulated drilling; summing magnitudes of the radial forces with respect to a direction to generate a sum of the radial forces; comparing the sum of the radial forces to an applied weight on bit; generating a ratio between the sum of the radial forces and the applied weight on bit; adjusting at least one parameter of the selected drill bit based on the generated ratio *until the magnitude of the radial forces is less than a predetermined value for a preselected time for a simulated drilling*; and outputting a drill bit design based on the generated ratio and the adjusting.

As amended, independent claim 46 requires, in part, a method for designing a bottomhole assembly, including: determining radial forces acting on a bottom hole assembly during simulated drilling, said bottomhole assembly including a drill bit; summing magnitudes of the radial forces with respect to a direction to generate a sum of the radial forces; comparing

the sum of the radial forces to an applied weight on bit; generating a ratio between the sum of the radial forces and the applied weight on bit; adjusting at least one parameter of the bottom hole assembly based on the generated ratio *until the generated ratio is less than a predetermined value for a preselected time for a simulated drilling*; and outputting a bottom hole assembly design based on the generated ratio and the adjusting.

Applicant notes that embodiments of the present invention may be used advantageously to minimize radial force imbalance that may result in a whirl effect and reduce cutting efficiency of a drill bit. Embodiments of the present invention may increase the life of a bit by preventing damage due to repetitive impact of the cutting structure against the walls of the wellbore during drilling.

As described in the present Application at paragraph [0004], imbalances between radial forces may cause a rock bit to gyrate (*i.e.*, "whirl"). For example, roller cones independently rotate about an axis oblique to the axis of the bit body. Due to this orientation, a conventional rock bit may experience unbalanced lateral forces (radial forces) that cause the rock bit to gyrate or laterally bounce on the bottomhole and impact the wellbore during drilling, a motion commonly known as whirling. Bit whirling is an undesirable performance characteristic because it results in inefficient drilling of the bottomhole and may also result in premature bit damage. Therefore, analysis of radial forces acting on the bit (*i.e.*, as a ratio to weight on bit) allow improvements in design, which may include reduced bit whirl (Present Application, paragraph [0005]-[0006]).

As described in the present Application at paragraph [0041], a criterion may include "a magnitude of the resultant force [that] is less than a predetermined value for a selected

percentage of the time spent drilling." Thus, claims 45 and 46 require, in part, adjusting at least one parameter based on a generated ratio until the magnitude of the radial forces, or the generated ratio, is less than a predetermined value for a preselected amount of time for a simulated drilling.

As discussed in the Response to Office Action dated September 9, 2008, Ma relates to the kinematics of a roller cone bit, but does not show or suggest adjusting a value based on a preselected time, as required by claims 45 and 46. Likewise, Glass teaches a method for designing a PDC bit that involves balancing forces and torques acting on cutters while a bit is drilling through a transitional section between soft and hard rock formations. Specifically, Glass discloses optimizing a fixed-cutter drill bit so that cutter forces and torques are evenly distributed not only during drilling of homogeneous rock, but also in transitional formations. (Glass, Abstract). However, Glass does not teach adjusting a value based on a preselected time, as required by amended claims 45 and 46.

As discussed above, Beaton is limited to bi-center drill bits; specifically, Beaton discloses bi-center drill bits having certain arrangements of pilot blades and pilot sections and reaming blades and reaming sections. (Beaton, Abstract). More specifically, Beaton relates to bi-center drill bits that are force balanced over the entire bit by calculating the forces exerted by each PDC cutter individually and selecting the locations of the blades and the PDC cutters thereon such that the sum of all the forces exerted by each of the cutters has a net imbalance of less than about 10 percent of the total axial force exerted on the bit (known in the art as the "weight on bit").

Similarly, Beaton2 discloses bi-center bits designed such that the imbalance forces that result from the cutting action of the reaming cutters are offset by forces resulting

from the cutting action of the remaining cutters so that the overall total of the imbalance forces on the bit is minimized. (Beaton2, col. 3, lines 35-41).

Ma and Glass, whether considered separately or in combination, do not teach or suggest the present limitation of adjusting at least one parameter based on a generated ratio until the magnitude of the radial forces, or the generated ratio, is less than a predetermined value for a preselected amount of time for a simulated drilling, as required by amended claims 45 and 46. Thus, claims 45 and 46, as amended, are patentable over Ma, Glass, Beaton, and Beaton2. Dependent claims are allowable for at least the same reasons.

Beaton and Beaton2 each fail to disclose that which Ma and Glass lack. Specifically, Beaton and Beaton2 do not teach or suggest adjusting a parameter based on a generated ratio until the magnitude of the radial forces (or generated ratio) is less than a predetermined value for a preselected amount of time, as required by amended independent claims 45 and 46. Therefore, independent claims 45 and 46, as amended, are patentable over Ma, Glass, Beaton, and Beaton2, whether considered separately or in combination. Dependent claims are allowable for at least the same reasons. Thus, claims 2-9, 11-23, 25-38 and 40 are patentable for at least the same reasons.

Improper Hindsight Reconstruction

Applicant respectfully notes that the use of the present application as a "road map" for selecting and combining prior art disclosures is wholly improper. *See* MPEP § 2143; *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132 (Fed. Cir. 1985) (stating that "[t]he invention must be viewed not with the blueprint drawn by the inventor, but in the state of the art that existed at the time"); *In re Fritch*, 972 F.2d 1260 (Fed. Cir. 1992) (stating that "it is

impermissible to use the claimed invention as an instruction manual or 'template' to piece together the teachings of the prior art so that the claimed invention is rendered obvious .... This court has previously stated that 'one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention.'"); *In re Wesslau*, 353 F.2d 238 (C.C.P.A. 1965) (stating that "it is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.") As such, the Examiner must construct any rejection under 35 U.S.C. § 103 in such a manner as to not exercise hindsight reconstruction of the invention from a plurality of prior-art references.

The Examiner appears to be engaging in hindsight reconstruction using the present application as a guide, to arbitrarily pick and choose isolated features of Beaton, Beaton2, Ma, and Glass to arrive at the claimed limitations. As noted above, Beaton and Beaton2 are directed to bi-center drill bits and Glass is directed to PDC drill bits, whereas Ma is directed to roller cone drill bits. Furthermore, the limitations arbitrarily selected by the Examiner are from non-analogous art and may not be functional when combined. The fact that the Examiner has combined arbitrary features from non-analogous references is evidence that the Examiner has engaged in picking and choosing of isolated features with no suggestion or motivation to do so.

In view of the above, the Examiner's contentions fail to support an obviousness rejection of the claims in view of Beaton, Beaton2, Ma, and Glass. Thus, independent claims 45 and 46 are patentable over Beaton, Beaton2, Ma, and Glass, whether considered separately or in

combination. As stated above, pending dependent claims are patentable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number [05516/148002]).

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Respectfully submitted,

By _____

Jeffrey S. Bergman
Registration No.: 45,925
OSHA · LIANG LLP
909 Fannin Street, Suite 3500
Houston, Texas 77010
(713) 228-8600
(713) 228-8778 (Fax)
Attorney for Applicant